Patterns of Drug Use from Adolescence to Young Adulthood: I. Periods of Risk for Initiation, Continued Use, and Discontinuation

DENISE B. KANDEL, PHD, AND JOHN A. LOGAN, PHD

Abstract: Patterns of initiation, continued use, and decline in drug use are described on the basis of detailed drug histories in a longitudinal cohort representative of former New York State adolescents. In this cohort, the period of major risk for initiation to cigarettes, alcohol, and marijuana, is completed for the most part by age 20, and to illicit drugs other than cocaine by age 21. Those who have not experimented with any of these substances by that age are unlikely to do so thereafter. Initiation into prescribed psychoactive drugs occurs at a later age than for the licit and illicit drugs and continues through the age period covered by the survey. A potential maturational trend in marijuana use in this cohort is apparent with a decline beginning approximately at age 22.5 for most usage patterns. The periods of highest marijuana and alcohol usage decline beginning at ages 20–21 and contrast sharply with cigarettes which exhibit climbing rates of highest use through the end of the surveillance period (age 25). Overall patterns are similar for men and women, with men initiating all drugs at higher rates than women, except for prescribed psychoactives. (*Am J Public Health* 1984; 74:660–666.)

Repeated cross-sectional epidemiological surveys of the general population have documented strong age-related trends in patterns of legal, illegal, and medically prescribed psychoactive drugs. The most important trends are the onset of experimentation with legal and illegal drugs in early adolescence, the substantial increase in medical prescription of psychoactive drugs in the middle twenties, and the apparent peaking in the use of illicit drugs in the years 18–22.[1] However, in any cross-sectional survey, age comparisons are based on different cohorts and therefore confound two possible processes: maturational changes associated with chronological age, and historical differences among cohorts with different life experiences, in this case different rates of opportunities to use drugs in adolescence. In order to identify possible maturational trends, the same individuals need to be followed over time. The optimum design is a cohort sequential design, although even in such a design the effects of historical factors cannot be completely eliminated. Such studies are extremely complex and costly. *Monitoring the Future*,[2] based on national cohorts of high school students, is the only study implemented so far that deals specifically with drug behavior. To date, there has appeared only one longitudinal report on patterns of drug use from adolescence through young adulthood, for males followed from high school to age 24 in 1974.[3]

Relying on detailed retrospective reports obtained through drug histories that reconstructed drug behaviors on a monthly basis, we describe patterns of initiation, stabilization, and decline in drug use in a longitudinal cohort of young adult men and women through age 25. These data provide some hitherto unavailable information on the phenomenology of drug involvement in adolescence and young adulthood.

Methods

Sample and Field Procedures

The analyses are based on a follow-up in 1980–1981 of a sample representative of adolescents formerly enrolled in grades 10 and 11 in public secondary schools in New York State in Fall 1971. In the original two-stage random sample, students were selected from a stratified sample of 18 high schools and clustered in homerooms stratified to represent the different grades within each school. The target population for the follow-up was drawn from the enrollment list of half the homerooms from grades 10 and 11, with high marijuana-using homerooms sampled at twice the rate of the others.

Students who had not participated either in the Fall or Spring waves of the initial study, and were presumably chronic absentees, were also selected for inclusion to permit unbiased estimates of the former student population at the time of the adult follow-up. With a completion rate of 81 percent, 1,325 persons were interviewed, at the mean age of 24.7 years. The field work was carried out by NORC-University of Chicago.

The data were obtained through personal household interviews based on a structured schedule and two charts designed to reconstruct on a monthly basis the respondents' drug and life histories. Information was collected on the histories of use of 12 drugs: two legal, four illegal, and six drugs that should be used only under medical prescription but that are also used on one's own. The specific drugs inquired about are listed in Table 1. Colored pill charts developed for use in the general population[1] were used to increase the accuracy of respondents' reports about the use of sedatives, stimulants, and minor tranquilizers. While age of onset was ascertained for all users of each drug, the detailed retrospective drug histories, including periods of highest use, were obtained for drugs used a minimum of 10 times. Specific dates of onset of use were ascertained for beer, wine, and distilled spirits separately, but periods of use for alcoholic beverages did not distinguish among them, in order to reduce respondents' burden. The sampling weights applied to the 1980 data took into account all relevant features of the sampling design, including the oversampling of high marijuana-using homerooms and the lower sampling rate of former absentees.

Consistent with findings of other longitudinal studies, the non-participants in the follow-up were already somewhat different as high school students from the participants. The non-interviewed were more likely to be enrolled in New York City schools, to be male, black or Hispanic, to reside in mother-headed families, to be less successful academically and to be more heavily involved in drugs, except alcohol,

From the Department of Psychiatry and School of Public Health, Columbia University, and the New York State Psychiatric Institute. Address reprint requests to Denise B. Kandel, PhD, Professor, Department of Psychiatry, Columbia University, 722 West 168th Street, Box 20, New York, NY 10032. This paper, submitted to the Journal February 16, 1983, was revised and accepted for publication June 13, 1983. Presented at the annual meeting of the Society for Social Problems, Detroit, August 30, 1983.

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TABLE 1—Lifetime Prevalence of Legal, Illegal, and Medically Prescribed Psychoactive Drugs in New York State Young Adult Cohort at Age 24.7, 1980

	Proportions Who Ever Used			
	By Follow-up			By Age 18
	Males	Females	Total	Total
Alcohol, (beer, wine or distilled spirits)	99	98	99	95
Cigarettes	80	79	79	68
Marijuana	77	68	72	54
Psychedelics	31	20	25	18
Cocaine	37	23	30	8
Heroin	5	1	3	1
Non-prescribed				
Methadone	1.0	0.1	0.5	0.1
Minor tranquilizers	18	15	17	7
Sedatives	23	15	19	10
Stimulants	28	18	23	10
Major tranquilizers	3	0.4	2	0.7
Anti-depressants	1	0.5	0.8	0.1
Prescribed				
Methadone	2	0.3	1	0.5
Minor tranquilizers	19	28	24	7
Sedatives	9	6	8	2
Stimulants	3	9	7	2
Major tranquilizers	2	2	2	0.9
Anti-depressants	1	3	2	0.8
TOTAL N	(706)	(619)	(1,325)	(1,325)

than the reinterviewed.[4] However, the distributions of Time 1 characteristics are similar in the reinterviewed group and in the total target Time 1 sample. For most variables, the amount of bias in the estimates is very low (about 1 per cent), leading to the conclusion that the follow-up cohort constitutes a representative sample of the 1971 high school enrollment in grades 10 and 11 in New York State.

The analyses based on retrospective reports will be affected by biases inherent in such reports (see Appendix). Unreliability in recall affects the results to an unknown degree and must be kept in mind in the interpretation of the data.

Life-Table Analysis

Although obtained retrospectively, the continuous observations on the use of various drugs over the follow-up interval allow drug behavior to be examined as a dynamic process through life-table analysis.

The life-table method estimates two functions. The survival function assigns each point in time a value that is the proportion of respondents in the cohort who have not experienced the event of interest, i.e., the non-use of each substance. One minus the value of the survival function is the life-time prevalence of use at that time point. The hazard function estimates the rate of occurrence of the event within a period among those estimated not to have undergone the event during the interval, i.e., the incidence of drug use during the period. The hazard function is the derivative with respect to time of minus the log of the survival function.[5] The existence of an age-specific risk factor makes the interval in which it operates different both from prior and subsequent periods. The existence of a maximum point in the function is interpreted as a developmental process in which risk increases with exposure, and in which maturation occurs after a certain point in time.

Hazard and usage rates are presented as a function of chronological age.*

Results

Overall Prevalence of Drug Use

As background to the analyses, it is useful to consider the overall lifetime prevalence of use of various drugs in the cohort by the time of the reinterview (Table 1). Drugs vary widely in their prevalence of use, paralleling well-described epidemiological trends.[1,2,6] Alcohol (including use of beer, wine, or distilled spirits) has been used by almost every single member of the cohort, followed by cigarettes and marijuana. Of the other illicit drugs, the most prevalent are cocaine and the psychedelics. Among the medically prescribed drugs, the minor tranquilizers are most prevalent. As is typical of general population samples, only a small minority report ever having used heroin. Male use of most drugs is consistently higher than female, but women have higher use of prescribed minor tranquilizers and stimulants.

Initiation of Use of Psychoactive Drugs

Figure 1 displays the hazard functions, i.e., proportions of the remaining never-users who begin use in each year of

*The surival function of the SPSS program was utilized to obtain the rates. Since drug use in these analyses is considered as a function of time, alternate ways of measuring time were considered: age and high school grade cohort. The proportions using each drug during the month of the Time 1 survey (in late 1971) and during January 1980 were fitted as a function of school class (1973 or 1974) and year of birth (1953 through 1957, entered as an interval measure). The 1,096 cases matched to Time 1 data were used in the Time 1 analysis, while all cases with Time 3 data were used for the 1980 analysis. A logit specification was selected for the fitting. All models were tested for interactions between school class and birth year in their effects on drug use, and were fitted both for sexes separated and combined. No significant interactions were found. The failure to find strong school class effects led to the selection of chronological age for analyzing and plotting the data.

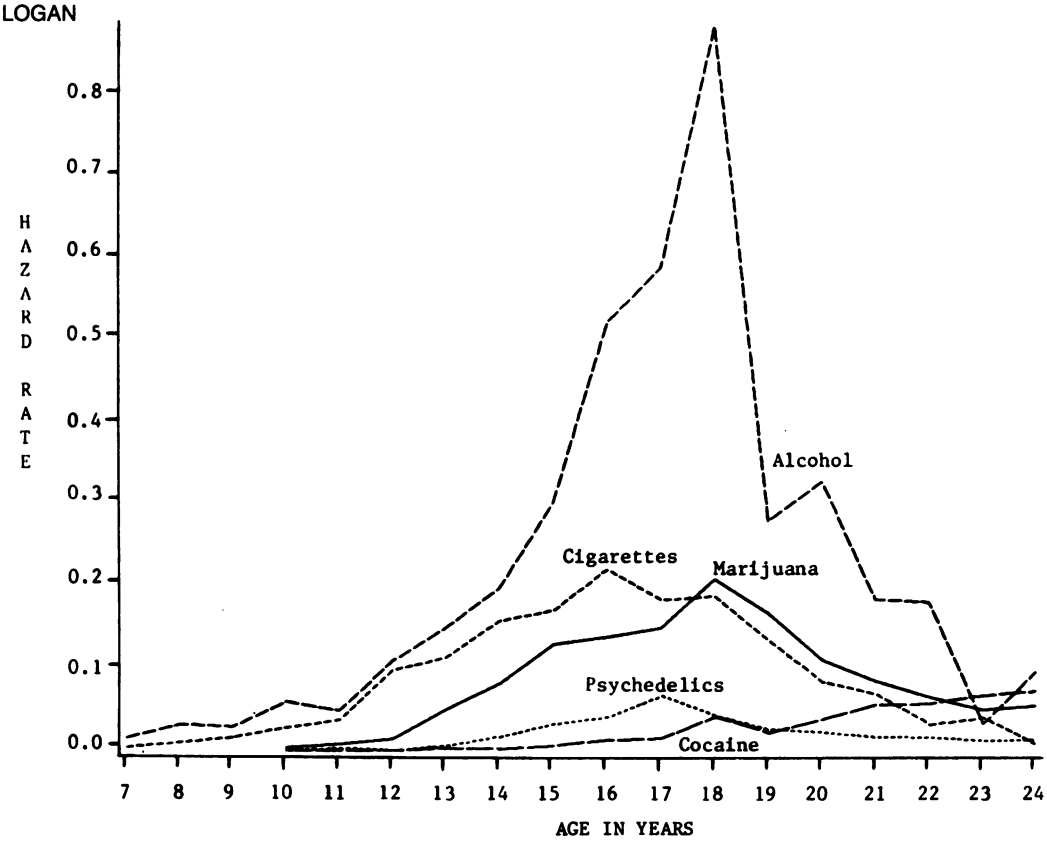

FIGURE 1a—Hazard Rates (Initiation) by Age for Alcohol, Cigarettes, Marijuana, Psychedelics, and Cocaine

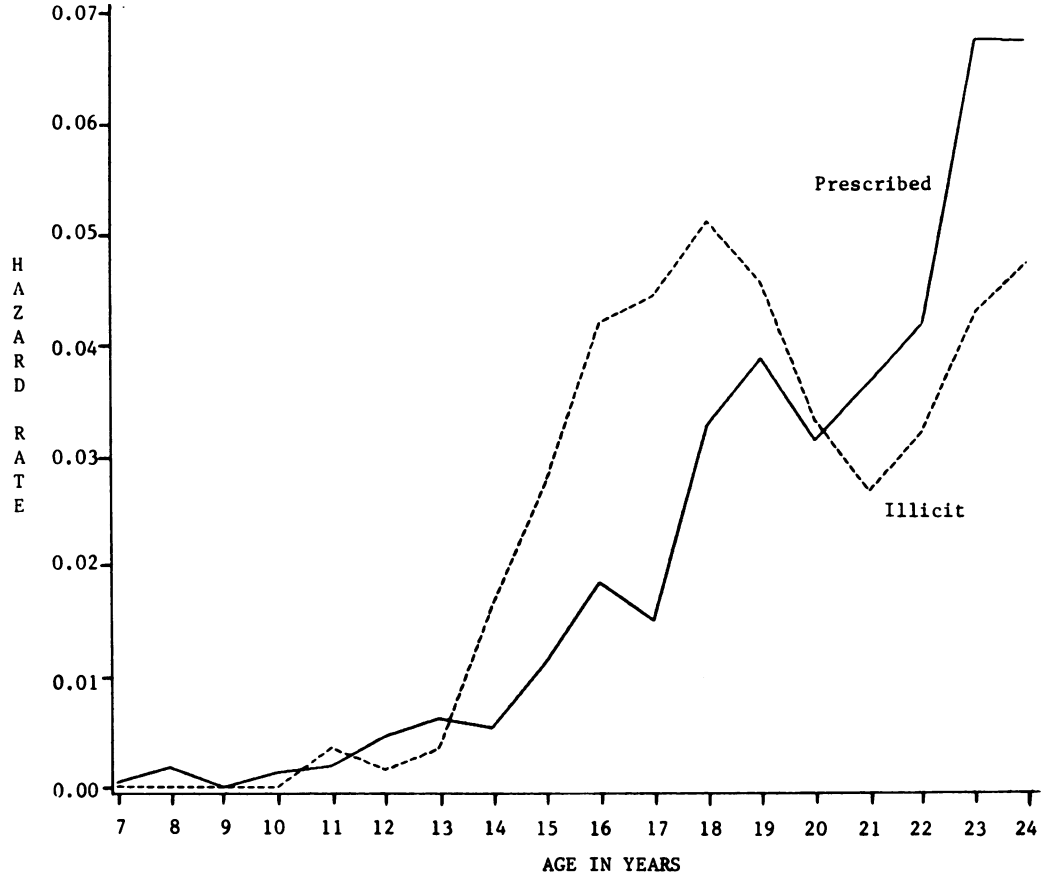

FIGURE 1b—Hazard Rates (Initiation) by Age for Illicit and Prescribed Psychoactives: Minor Tranquilizers, Sedatives, and Stimulants

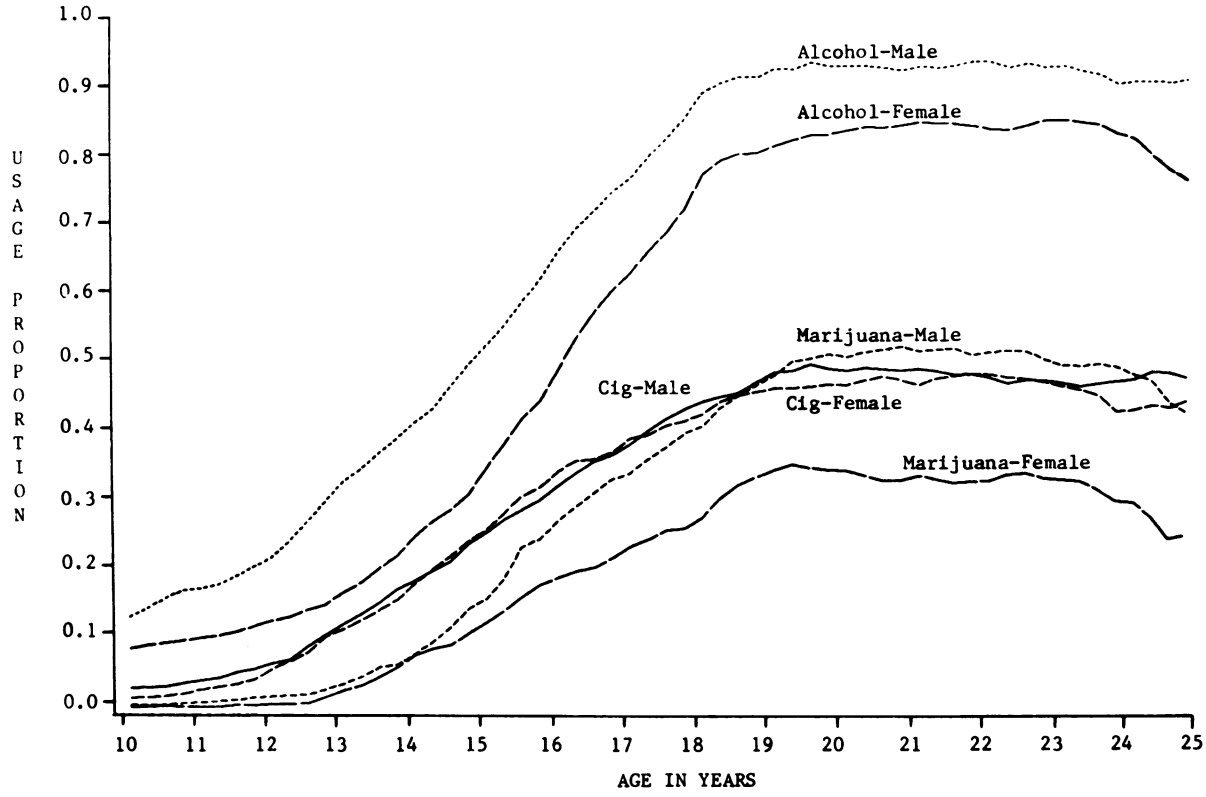

FIGURE 2a—Usage by Sex and Age of Cigarettes, Alcohol, and Marijuana

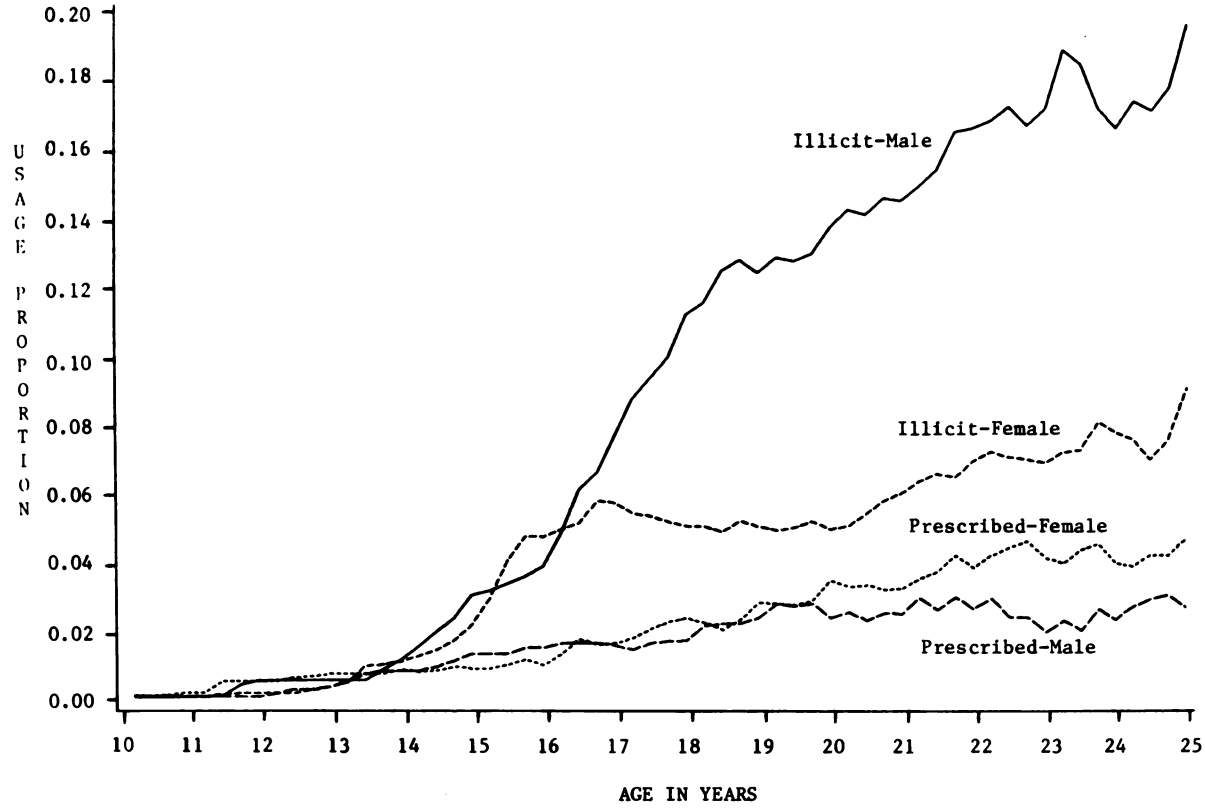

FIGURE 2b—Usage by Sex and Age of Other Illicit and Prescribed Psychoactive Drugs

life, for seven drug classes for the total cohort, since overall patterns for men and women follow the same configurations. For the psychoactives (i.e., minor tranquilizers, sedatives, and stimulants), a distinction was made according to whether use was medically prescribed or on one's own.**

Alcohol use beings early in life, with almost 20 per cent of the cohort having ever used by age 10 and over 50 per cent by age 14. The rate of initiation begins to increase about age 18 (the legal drinking age in New York State), when the remaining never-users have a .87 probability of initiating (Figure 1a). Initiation after age 18 occurs at much reduced rates.***

Although similar, at first, to that for alcohol, the rate of initiation for cigarettes does not show the steep rise at age 15 and does not show as sharp a decrease at age 18.

The rate of initiation for marijuana begins to climb at about age 13 and reaches a peak of .20 at age 18 with the sharpest dropoff between ages 19 and 20. Marijuana shows a higher residual rate of initiation at ages 23 and 24 than either alcohol or cigarettes.

Psychedelics and cocaine are the illicit drugs other than marijuana that are used with the highest frequency. Psychedelics exhibit a pattern similar to marijuana. The end of the major period of risk is at age 18. The pattern of initiation of cocaine is quite different and is almost certainly affected by the recent historical expansion in its popularity. About 8 per cent had used cocaine by age 18, but 30 per cent had done so by age 24. The rate of initiation rose until age 24, when it was almost .07, a continuing rise not seen for any other illicit drug.

Starting with lower rates of initiation than those observed for the non-medical use of these drugs, rates for prescribed use continue to rise through the period of observation (Figure 1b). Between ages 20 and 21, rates for prescribed use are higher than for non-prescribed use. The rates of initiation at age 23 are almost twice (1.75) those observed at age 22.

The age by which 90 per cent of the users of each drug had initiated use indicates that initiation to alcohol is almost completed by age 18, to cigarettes by age 19, to marijuana by age 20, and to psychedelics by age 21. In this cohort, the risk of young people who have not initiated marijuana by age 20 to initiate at some later time is very small.

Rates of initiation to drugs follow parallel patterns among men and women (data not presented). Males, however, generally initiate at higher rates and continue to increase at faster rates than females, with the exception of the prescribed psychoactive substances. These drugs are the only ones for which females show consistently higher rates of initiation than males.

Periods of Stabilization and Decline in Drug Usage

After initiation, use of a drug may or may not persist. Use in any monthly period during the retrospective period was examined for men and women separately for: cigarettes, alcohol, marijuana, other illicit drugs (including psychedelics, cocaine, heroin, non-prescribed use of minor tranquilizers, sedatives and stimulants), and medically prescribed psychoactive drugs. Quarterly averages of monthly use are displayed in Figure 2.

Male use of alcoholic beverages consistently exceeds female use. Alcohol use stabilizes about midway through the eighteenth year, where male use is 90 per cent and female use is 80 per cent.

Quarterly averages of monthly use of cigarettes by age show consistent patterns among men and women with an increase in use at approximately age 12, and consistent increases thereafter. Stabilization occurs after age 18 for both sexes.

While there is no clear differentiation of the marijuana usage curves for males and females in early adolescence, a difference is clearly established by age 18. Marijuana stabilizes at about age 19, slightly earlier for women (18.9 years) than for men (19.4 years). The early twenties are a period of very active marijuana use, when 50 per cent of males and about 33 per cent of females report using the drug in any month in that period. Use begins to decline at age 23 for both sexes.

Use of illicit drugs other than marijuana begins around age 14 for men and women and essentially continues to rise until the end of the period of observation. Usage is higher among males than females.

Use of prescribed psychoactives among females continues to rise slightly during young adulthood, while it stabilizes among males. This low usage rate contrasts with the higher cumulative levels of initiation. By age 23, the proportion of those who have ever used one of the drugs by prescription and who are still currently using is approximately 13 per cent as compared to 25 per cent for other illicit drugs, 60 per cent for marijuana and cigarettes, and 90 per cent for alcohol. There is less persistence of use of the prescribed drugs after initiation, which is consonant with the goal of time-limited prescriptions.

Periods of Highest Drug Use

A maturational trend in marijuana and alcohol use in this cohort appears more clearly when periods of highest use rather than use per se are examined from adolescence to young adulthood (Figure 3). Periods of highest use for marijuana and alcohol decline sharply after age 20. The contrast with cigarettes, with rates rising up to the time of the follow-up interview, is striking. Periods of highest use for alcohol and marijuana occur over a narrower age span than periods of use per se (although the period lasts longer for alcohol than for marijuana), and occur about a year later for males than for females. For alcohol, highest usage peaks at around ages 19–20 for males, and ages 18–19 for females. For the individuals involved, the periods of highest use represent periods of heavy drug involvement. In their period of most intensive drinking, 51 per cent of the alcohol users reported drinking alcohol at least four times a week (24 per cent daily), with 50 per cent reporting drinking an average of five drinks on a drinking day. In their period of highest use, 50 per cent of the marijuana users were using marijuana at least four times a week (30 per cent daily); 56 per cent were smoking at least two to three joints a day. Among smokers of tobacco cigarettes, 87 per cent were smoking daily, an average of one pack or more per day.

Discussion

Analyses based on detailed drug history data defined patterns of initiation, stabilization, and decline in drug use

**Prevalence of use and hence rates of initiation were so small for heroin, methadone, anti-depressants, and major tranquilizers compared with their standard errors that their periods of risk could not be delineated.

***Initiation of use of distilled spirits lags behind beer and wine in the younger ages (data not presented). The age by which at least 10 per cent have ever tasted an alcoholic substance is age 10 for beer and wine, but age 13 for distilled spirits.

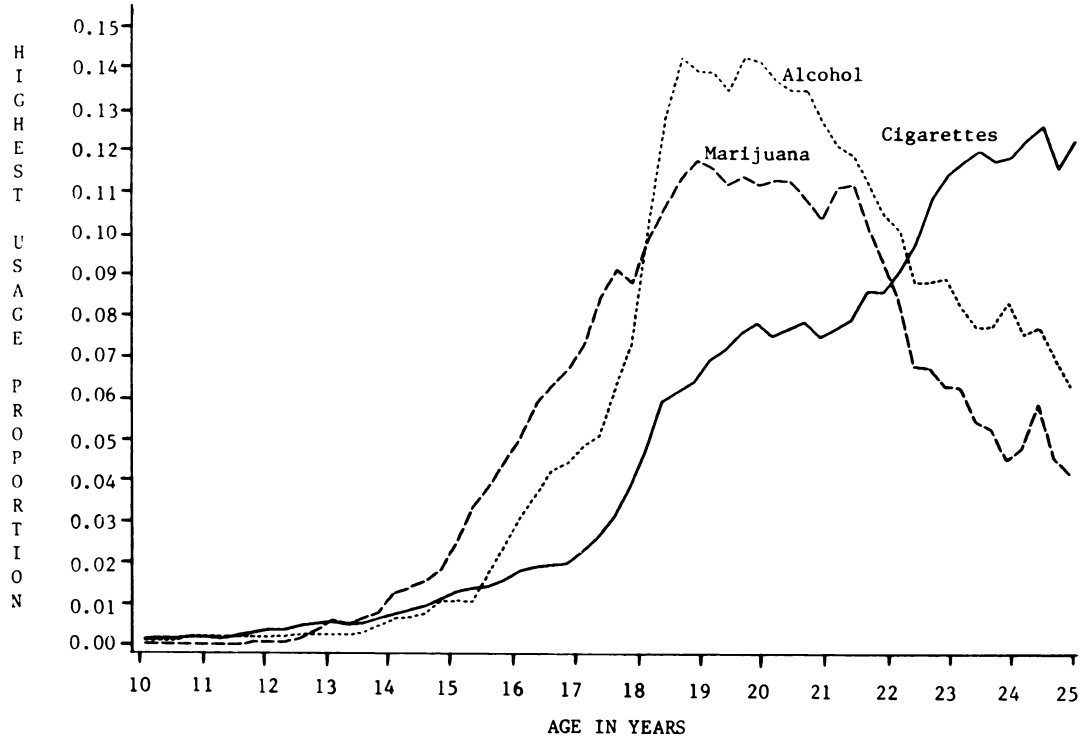

FIGURE 3—Period of Highest Use for Alcohol, Cigarettes, and Marijuana by Age as a Proportion of All Users

and have delineated potential maturational changes in a single longitudinal cohort. The limitations of development conclusions based on a single cohort must be stressed. Caution must be exercised in extrapolating these findings to other areas and other times.

In summary, for the legal drugs (cigarettes and alcohol) and for most illicit drugs, the period of highest risk for initiation peaks at age 18, and declines thereafter. Cocaine is a striking exception, with initiation rates increasing after age 19, and reflects historical differences in the introduction of the drug on the market. Initiation into the prescribed psychoactive substances occurs at a later age than for the licit and illicit drugs. Rates of initiation of prescribed psychoactives increase sharply at age 18, in the same period when initiation of illicit drugs first subsides, and persists at an increasing rate through the mid-twenties. Prescribed psychoactive drugs may partially fulfill the same functions in a later phase of the life cycle that were earlier fulfilled by illicit substances.

By following a cohort through time, we have identified patterns of involvement in illicit drugs that strongly suggest the existence of a maturational process. It must be emphasized that results based on a single cohort still confound to some extent maturational with historical trends. However, the convergent results from age comparisons derived from repeated national cross sectional surveys[1] provide evidence in support of the notion of a maturational process in illicit drug use, with an historical factor superimposed. In these national surveys, the ratio of current use (in the last month) to lifetime experience increases through the late teens but starts to decrease significantly in the early twenties, and at an increasing rate thereafter. Comparison of the 1979 and 1977 surveys, however, indicates that for each age group older than 17, these ratios were higher in 1979 than in 1977 and that the historical differences increased directly with the cohorts' age. While overall current prevalence may show variations from cohort to cohort, the decline in use with age appears to be consistent throughout each cohort.

Why such a decline takes place in the middle twenties is a matter for future inquiry. We would like to suggest that this decline reflects a process of psychosocial maturation and coincides with the assumption of the roles of adulthood in this period of the lifespan. These roles—such as getting married, entering the labor force, or becoming a parent—are conventional roles that may be incompatible with involvement in illicit drugs and deviant lifestyles.

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APPENDIX

Reliability and Validity of the Retrospective Life History Data

Although validity of recall has been previously established for reports of certain drug use patterns,[7,8,9] underreporting, telescoping, and distortions have generally been shown to affect recall of various life events.[10] As stressed by Featherman,[11] however, distortions in retrospective reports may not necessarily be greater than those in contemporaneous ones.

In order to assess the validity of retrospective reports in the following interviews, we compared‡: 1) reports in 1980 for similar events reported on in 1971; and 2) rates of retrospective self-reported drug use for 1977 with rates for the same age cohort interviewed contemporaneously in 1977 in the General Household Survey.[1] The majority of recalled-use patterns are consistent with those reported in 1971, especially for marijuana: 79 per cent of males and 85 per cent of females give consistent reports, although young people who reported no use in high school are more consistent than those who reported use. The marginal distributions in reported lifetime prevalence are identical at both points in time (27 per cent), but only because an equal number of persons gave inconsistent reports from the initial non-using (n = 88) and using (n = 86) groups. However, while in 1971, 259 adolescents reported to have already used marijuana, in 1980, 173 of these same persons remembered having done so. The inconsistencies are larger for cigarettes and for alcohol than for marijuana. Thus, the distributions of self-reported users in 1971 were 71 per cent for cigarettes and 86 per cent for alcohol, whereas only 49 per cent and 68 per cent, respectively, recalled being users by 1980. Most of the inconsistencies represent failures to recall Time 1 use at Time 3 as well as discrepancies in the ages of onset of use recalled in young adulthood by those who had indicated in 1971 that they were already using certain drugs, with a greater proportion reporting a later age of onset than was reported initially.‡

Although there appears to be a consistent foreshortening of time in the recall process, there must be gradual adjustments over the life span being recalled. The annual prevalence of marijuana use (44 per cent) reported retrospectively for 1977 at age 21–22, three years prior to the 1980 interview, is almost identical to that reported contemporaneously (41 per cent) by members of parallel birth cohorts in the General Household Survey (see Fishburne, *et al*[1]: Table 18).

‡Raveis V, Kandel D: Retrospective recall error in a longitudinal study of former New York State high school students (unpublished).

Water Resources Conference/Symposium to Meet in DC

The American Water Resources Association will conduct its 20th Annual Conference and Symposium August 12–17, 1984 at the Loews L'Enfant Plaza Hotel in Washington, DC. The *Conference* theme is "Overcoming Institutional and Technical Constraints to Water Resources Management."

The program features 17 technical sessions on such topics as Institutions for Managing Regional Water Resources Systems, Data Needs for Analyzing the Performance of Water Resources Systems, Models for Coordination of Water Resources Plans and Programs, Research to Support Improved Water Management, Regional Water Resources Planning and Management, State-Federal Relationships—Assignment of Responsibilities, and Assessing the Nation's Water Resources.

The topic of the *Symposium* is "Options for Reaching Water Quality Goals". The session will be keynoted by Representative James H. Scheuer, Chairman, House Subcommittee on Science, Research, and Technology, of the Committee on Science and Technology. His presentation is entitled "A National Environmental Monitoring System: An Essential Step Toward Achieving Water Quality Goals".

Concurrent sessions will focus on: Institutional Aspects of Non-Point Source Pollution, Technical Aspects of Non-Point Source Pollution, Ground Water Pollution Control, and Monitoring for Water Quality.

A preliminary program registration information may be obtained by contacting Kenneth D. Reid, Executive Director, American Water Resources Association, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814.